Description

Input device, especially for a mobile telephone, module comprising an input device, mobile telephone and method for the production thereof

The present invention relates to an input device, especially for a mobile telephone, a module comprising an input device, a mobile telephone and a method for the production of an input device, a module and/or a mobile telephone.

Design trends are increasingly at the fore in modern devices. As well as the visual impression made by a device, much importance is attached to constantly improving the ease of handling of the device concerned. At the same time, the miniaturization of portable electronic devices with inputting facilities is leading to devices with ever smaller surface areas and volumes, so advances in technological development, especially in mobile telephones, are leading to ever smaller devices overall. The design space available for keypads among other things is consequently becoming smaller and smaller, which can have a very detrimental effect on the user-friendliness of such devices.

A minimum volume of a keypad is determined by the following criteria: key surface area, key spacing and the projection of the keys relative to the housing, which projection influences the key height. The volume of keypads will be smallest where a respective key cap remains as flat as possible. The area of keypads will then be smallest where the key spacing approaches zero, i.e. the keys will no longer be separated from one another by housing support frames and will thus be individually held in a form-locking manner in the housing, as is known in PC

keyboards.

Without restricting the scope of the invention to this application field, only mobile telephones and the input devices thereof will be examined hereinbelow, due to their small structural size, the heavy mechanical loading on them caused by dialing operations and especially by the sending of short written messages in the form of SMS messages, as well as to their being produced under very great cost pressures.

According to the prior art, input devices with keys are known, the externally accessible caps of a user interface of which are each fitted on at least one side with a flange. The cap rests with at least one flange against corresponding housing support frames in order to prevent it from falling or springing out. Without housing support frames, which are generally present between all the keys, such securing is possible only in an area of contact between keypad and housing or keypad and upper housing shell. In particular, the keys with the dial numbers 5 and 8 will thus in conventional mobile telephone keypads no longer be adequately secured to prevent the entire keypad, held in the housing without any support frames, from sliding out or being torn out.

In a known input device with individual keys without support frames, the keys are fastened onto a flexible plastic carrier. The flexible plastic carrier must for its part be firstly mechanically very stable in order to secure the input device in the housing and/or to act as a backing system and secondly also highly flexible in order to ensure operability of the individual keys. These requirements are so conflicting that a workable compromise can only be found to a highly restricted degree. With housing dimensions continuing to shrink, long-term

functional reliability is no longer guaranteed.

From EP 1 156 643 A2, a keypad for a mobile telephone is known, in which the keypad caps, not separated from one another by housing support frames, are fixed on a flexible, film-type carrier. The film carrier is fashioned for example as a silicon carrier. In one embodiment, the film carrier itself is bonded to a printed circuit board which for its part is held in an overlapping area in a form-locking manner by a surrounding housing by virtue of the fact that the film carrier has a circumferential flange. Accordingly, the result is a generally frame-like area of overlap between the flange and for example an upper housing shell in which the keypad is enclosed via combinations of hooks and eyes and/or pins and holes, held in a form-locking or force-locking manner and thereby fixed.

As a result of the miniaturization of devices overall, however, an overlapping area of contact between a respective keypad and a housing is becoming smaller and smaller, so as to ensure, without any further shrinkage in key size, a minimum degree of convenience of use and input reliability. Mechanical securing of a keypad or of a keypad module relative to a housing in the known form of interlocking by means of combinations of recesses or undercuts with corresponding support frames, hooks and/or studs is then no longer adequate. Simple and, in production engineering terms, readily implementable bonding of a keypad or keypad module to an upper shell for lasting protection of the keys to prevent the keys or the keypad carrier together with all the keys from falling or springing out has also proven inadequate.

As a result, a large amount of design space is needed in an area around the input device or the keypad of a mobile

telephone which could better be used to increase user-friendliness by relatively increasing the size of the individual keys. The only alternative is to change the design to comply with currently technically implementable forms, for example to enlarge the housing solely in order to fix the keypad securely. In this way, however, the overall device would have a housing that was larger than was actually technically necessary. This approach to a solution would, however, stand in the way of miniaturization.

The object of the present invention is therefore to propose an input device, a module comprising an input device, a mobile telephone and a production method which enable improved permanent fixing of an input device to and/or inside a housing.

This object is achieved according to the invention in an input device having the features of Claim 1, a module having the features of Claim 16 and a mobile telephone according to Claim 17. This object is also achieved in a method having the features of Claim 18. The subclaims define in each case preferred and advantageous embodiments of the invention.

An input device according to the invention, especially for a mobile telephone, comprising at least one cap which, in order to form at least one assigned key, is connected to a flexible carrier such that by pressing a key formed in this way an input signal is generated, is characterized in that at least one mechanically stable fixing means is arranged between a first plane comprising at least the cap and a second plane of the flexible carrier connected to the cap, such that the cap is configured, with the flexible carrier, to transmit force in a substantially punctual manner through the plane of the fixing means and such that the fixing means is configured in one area

of at least one terminal edge so as to secure the input device in or on a housing. The fixing means is enclosed in a form-locking manner between cap and carrier, thereby ensuring, within the limits necessary for key actuation, mobility of the cap as the actuator in a user interface.

In a further development of the invention, the mechanically stable fixing means is fashioned as a metal sheet. The metal sheet is advantageously fashioned in one embodiment of the invention as a lattice with recesses in the form of punched holes through which the individual keys can move in a direction of actuation within the limits necessary for triggering a signal. Based upon the target of a mechanically sufficiently stable fixing means which can safely be represented in the form of a metal lattice, very large recesses can also be selected so that in particular very good or substantially complete illumination of the respective key caps is possible.

In a preferred embodiment of the invention, a cap is molded onto the flexible carrier especially as the result of a thermoplastic molding and/or remolding process, after the fixing means has been assembled with the flexible carrier. In the area of the user interface perpendicular to a direction of actuation, the cap has in at least one spatial direction a dimension which is greater than an opening in the fixing means. The cap preferably has at least in one sectional plane parallel to the direction of actuation an approximately mushroom-like cross-sectional form. In one embodiment of the invention, the flexible carrier protruding through a recess of the fixing means at least in one area of a key then forms with the fixing means an indivisible module. Thus, in addition to improved handling through enlargement of the cap in contact with a finger of a user, this also achieves the outcome that the cap,

in the event of excessive force being used during signal input, cannot get stuck or be pressed in permanently through a recess in the fixing means. In interaction with the fixing means, the cap functions as a limitation on movement in the direction of actuation, as it were.

In an advantageous embodiment, however, in place of construction of the at least one key and the flexible carrier from one material, a multi-part and in particular multi-material design is provided. Here, the caps are manufactured as individual parts from, in particular, a translucent material and are connected to the flexible carrier. The materials can thus be optimally selected according to their respective intended application, i.e. the cap in terms of good and long-term wear-resistant pressability coupled simultaneously with good illumination, and the flexible carrier in terms of good long-term flexibility under continuous loading with no major tendency to crack or wear and also good dirt-resistance.

The at least one cap is preferably fixed to and/or on a projection of the flexible carrier. Here, on the other hand, all known methods of bonding, welding and/or positive coupling with or without thermal treatment, as well as combinations thereof, can be used.

In the two embodiments described previously, it is thus ensured that a cap or key of the input device is secured against springing out in the direction of an actuation movement and in the direction opposing such an actuation movement.

Depending on the embodiment concerned, either the caps on an operable exterior or user interface, said caps overlapping the respective recesses, protrude through the recesses, or else

projections or similar of the flexible carrier protrude through the recesses in the stable fixing means and are covered by the respective caps, to function as keys without support frames. The keys are thus fixed securely in a respective housing against the direction of actuation of each key.

In one embodiment of the invention, at least one terminal edge of the fixing means is configured, for securing the input device in or on a housing, as a type of overlapping periphery and/or flange, this preferably being two respectively opposing terminal edges of the fixing means. These areas can largely be shaped freely without influencing the actual input device.

In a particularly advantageous further development of the invention, a fixing means according to the invention is fashioned as protection against electrostatic discharge or as ESD protection. To this end, the fixing means is connected as an electrically conductive element internally in the housing to a grounding conductor, for example through a clamping contact which is produced automatically in the course of assembling the housing with the input device. This ensures leakage of ESD sparks.

In one embodiment of the invention, where the span widths or opening widths of a housing aperture are small, a fixing means is inserted loosely into the respective housing. Where the span widths are larger, however, the fixing means is preferably connected to the housing rigidly or in one piece as a sheet-metal part. In one embodiment, the fixing means and an associated housing part are also fashioned from one material and produced in one piece in an essentially joint production step.

According to the invention, just one simple production method creates the facility here for fixing to or in a housing an input device which can be simply and reliably fixed, whereby the input device as a whole lies freely movable in two spatial axes in a housing and is firmly held back by the fixing means as a backing sheet in the housing without additional bonding or other connecting technologies. The actual input device is necessarily and without further measures centered relative to the housing essentially by means of recesses in the fixing means, protruding through which the respective keys without support frames are fashioned. This has a beneficial effect on a chain of tolerance within the overall device, since no overdefined systems are formed as a result.

As well as a two-dimensional form, a three-dimensional form of a keypad surface can also be mechanically supported or even implemented here. This is brought about for example by bending the fixing means in an appropriately stable housing or by punching and bending the fixing means during its manufacture.

In addition, electrostatically discharging properties of a keypad according to the invention can be utilized at no additional cost. Where the actual device housing is equipped appropriately, an input device according to the invention can also be used to configure a closed Faraday cage.

Not least, as an ancillary effect of the proposed technical measure, a visible metallic reflection of the sheet-metal lattice can be used, at least in the key interspaces, for design purposes. By means of a surface treatment of the sheet-metal lattice, for example through anodization and/or inking, this effect can be used over the whole range of color design options, as described in detail below with reference to the

representation of the drawings based on concrete examples.

A fixing means according to the invention replaces a missing housing support frame, flanges or similar which otherwise normally anchor keys of an input device securely in a respective housing.

Based on a preferred embodiment, the present invention is described below with reference to the accompanying drawings in which:

Figure 1 shows a three-dimensional exploded diagram of an embodiment of an input device according to the invention and

Figure 2 represents a sectional diagram of the input device from Figure 1.

In Figures 1 and 2, elements having the same function and mode of operation are in each case labeled with the same reference characters throughout.

The three-dimensional exploded diagram in Figure 1 represents a diagrammatic assembly of an input device 1 according to the invention as a keypad 1a for a mobile radiotelelephone. In order to fashion a secure anchoring of the keypad 1a in a housing component 2, in this case an upper shell 2a of a housing which is not shown further here or of a housing aperture 3, a mechanically stable fixing means 4 is arranged in the form of a punched-out metal lattice 5 with recesses 6 between or in the transition of a plane A of a flexible carrier 7 in the form of a carrier mat 8 and a plane B with individual key caps 9.

In order to fashion an input device 1 with keys without support frames, projections 10 of the flexible carrier 7 protrude through the respective recesses 6 in the stable fixing means 4 and are covered by the respective caps 9. The keys are thus securely locked in a respective housing against an actuation direction P of each key.

As well as using a capacity of the fixing means 4 to withstand high mechanical loads, secondary use is also made of its metallically conductive property in that the fixing means 4 is deployed as a protective device against electrostatic discharges. To this end, an ESD terminal 11 is fashioned as a punched and bent part on the fixing means 4. In an assembled condition, this ESD terminal 11 is connected to a grounding lead of the internal electronics through the action of the contact pressure of the upper part of the housing when locked to the remaining housing of the mobile telephone.

Furthermore, recesses 12 are provided on the fixing means 4 and corresponding comparatively flat notches 13 are provided in the flexible carrier 7. Due to the higher mechanical performance capability of the metal sheet, the fixing means 4 alone can ensure, via the recesses 12 in interaction with lugs 14 of the upper shell 2a of the housing, an adequate fixing inside the housing. A corresponding flange and overlap area would have been too small in size for the flexible carrier to assume the same function, so that it no longer has to be used for this purpose at all. Accordingly, only flat notches 14 are provided here simply to facilitate positioning during assembly.

In order to fashion an input device 1 in the form of a complete module, a printed circuit board for configuring electrical N/O

contacts can be arranged in a known manner below the flexible carrier mat 7 with switching contacts (not shown in detail). This printed circuit board can also be connected to the flexible carrier mat 7 in one piece. However, this design of a finished input device as a one-piece module also behaves, in terms of positioning relative to the housing aperture 3 or the housing opening for the input keypad and its fixing in a predefined location, in precisely the same way as an arrangement shown in Figure 1 and consisting simply of the flexible carrier mat 7 with the individual key caps 9 fixed thereto.

Details will therefore be given, with reference to the sectional diagram in Figure 2, of this type of positioning and fixing effected by the fixing means 4, in contrast to the prior art. For this purpose, the diagram in Figure 2 has been represented in abbreviated form as a section along a plane A-A from Figure 1. The three points at which securing measures according to the prior art are taken are marked by circles drawn in dashed lines: M1 indicates the position in which a flange on the cap 9 has extended below in the area of the housing aperture 3 of the upper shell 2a for securing purposes. M2 indicates a position fastening by a flange fashioned similarly to M1 between adjacent caps 9. M3 shows a current fixing of a known input device 1 by a flange in the area of the flexible carrier 7. Here, an essential idea behind the present invention applies, as shown in the representation of Figure 2 in the area M3 by the dashed superimposition of a flange 16 in a terminal area 17 of the mechanically stable fixing means 4: in a direction P of a respective key movement or actuation direction, the flexible carrier 7 with key caps 9 fixed on the respective projections 10 of the flexible carrier 7 is freely movable to a sufficient degree, while the flexible carrier 7 is

held and allowed only very limited movement in a plane perpendicular to the direction of actuation P by the respective recesses 6 in the stable fixing means 4.

In order securely to prevent a pulling out of the input device 1 through the terminal area 3 and at the same time to effect automatic fixing of its position, at least one terminal edge of the fixing means 4 is, in order to secure the input device 1 in or on a housing 2, fashioned as a type of overlapping periphery 18 and/or flange 16 in the terminal area 17 of the mechanically stable fixing means 4. As shown in the sketch in Figure 2, these are preferably two respectively opposing terminal edges 19 of the fixing means 4.

In this way, at least in the area of mobile telephones, by loosely inserting a fixing means 4 in the form of a punched sheet-metal lattice 5 between key caps and flexible carrier material on a plane lying deeper in a respective housing 2, forms of retaining support frames can be implemented, by means of which an arrangement without support frames of the actual keys in the form of caps on a user interface O is possible.

As a special feature, the fixing means 4 in the form of a punched sheet-metal lattice 5 generates in interspaces z between the individual key caps 9 or between the key caps 9 and the adjacent upper shell 2a of the housing by virtue of its metal polish a special optical effect which, depending on the surface shape of the sheet-metal lattice 5, can be configured to fit an overall design concept, for example through coloring, etc. The resulting interspaces z between the caps 9 and/or a housing part are used without incurring additional expense in terms of metal optics or other design aspects.

The following reference characters and abbreviations, in particular, have been used within the scope of the present description of embodiments of the invention:

1 input device
1a keypad
2 housing part
2a upper shell of a housing
3 housing aperture
4 mechanically stable fixing means
5 metal lattice
6 recess in 4,5
7 flexible carrier
8 carrier mat
9 key cap
10 projection on 7,8
11 ESD terminal on 4,5
12 recess in 4
13 notch in 7
14 stud in 2a
15 terminal edge of 4,5
16 flange on 4,5
17 terminal area of 4,5
18 overlapping periphery of 4,5
19
A plane of flexible carrier 7
B plane with individual key caps 9
M1 ... M4 areas of fixing measures
P direction of a key movement / actuation direction
O user interface
SMS short message service
z interspace